HY311X ENOB Test

User Manual

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1. ENOB and Noise Free Description

RMS Noise that generated from Sigma Delta ADC is the minimum voltage value of distinguishable sampling signal. Hence, ENOB (Effective Number of Bits) is calculated by the ratio of RMS Noise and Full Scale Range. However, RMS Noise must be calculated by many average times. Insufficient sampling times can only represent RMS Noise for a specific period of time instead of the entire ADC operation. Therefore, RMS Noise operation times cannot be less than 1024 times.

However, Noise Free Bit represents that ADC output value count is not rolling. Noise Free Bits are stable ADC output performance. Bit operation is defined as Peak-to-Peak Noise and Full Scale Range ratio.

RMS Noise Equation:

$$\text{平均Count} \rightarrow \text{Average} = \frac{\sum_{k=1}^{n} \text{ADC}[k]}{n} \qquad (1)$$

$$\text{RMS Noise} = \frac{V_{RFE} \times \sqrt{\dfrac{\sum_{k=1}^{n} \left(\text{ADC}[k] - \text{Average}\right)^2}{n}}}{2^{Scale}} \qquad (2)$$

In the above equation, n represents total sampling number of ADC and Scale represents ADC total output bits. ENOB and Noise Free Bits can be gained by taking Equation 1 and Equation 2 to the following equation:

$$\text{ENOB} = Log_2\left(\frac{\text{FSR}}{\text{RMS Noise}}\right) = \frac{In\left(\dfrac{\text{FSR}}{\text{RMS Noise}}\right)}{In(2)} \qquad (3)$$

$$\text{Noise Free Bits} = Log_2\left(\frac{\text{FSR}}{\text{Peak-to-Peak Noise}}\right) = \frac{In\left(\dfrac{\text{FSR}}{\text{Peak-to-Peak Noise}}\right)}{In(2)} \qquad (4)$$

Equation of Peak-to-Peak Noise:

$$\text{Peak-to-Peak Noise} = \frac{V_{REF} \times \left(\text{ADC}_{Max} - \text{ADC}_{Min}\right)}{2^{Scale}} \qquad (5)$$

2. Hardware/Software Installation

2.1 Minimum System Requirements

1. Hardware Requirements:

IBM AT/ATX PC PENTIUM® or any above compatible type

Memory size > 32MB（>256MB is recommended）

Resolution > VGA 1024×768, 256-color display

Hard discs space > 10MB

USB port

2. Operation System

Windows™ 98SE

Windows™ 2000

Windows™ XP

Windows™ Vista

Windows™ 7

Not supportive for 64 bit window, *nix and OSX operation system. Menu could be unreadable code when operating in non-traditional Chinese operation system.

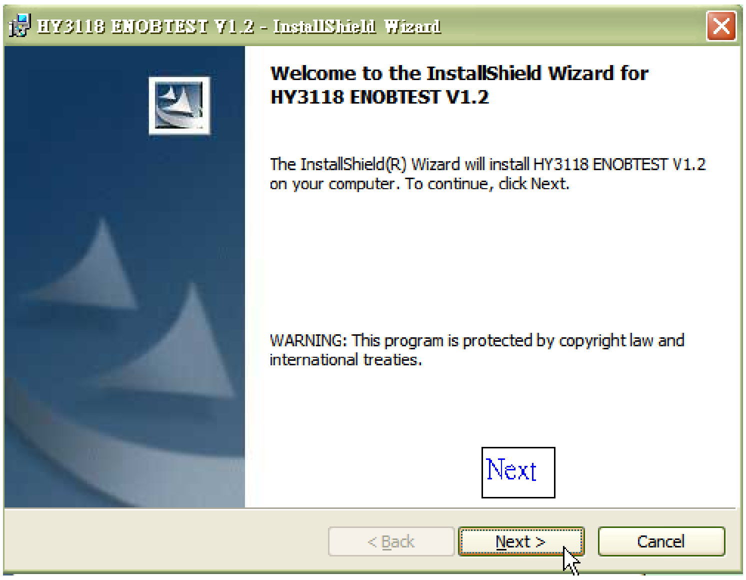
2.2 Installation and Removal

1. Software Installation

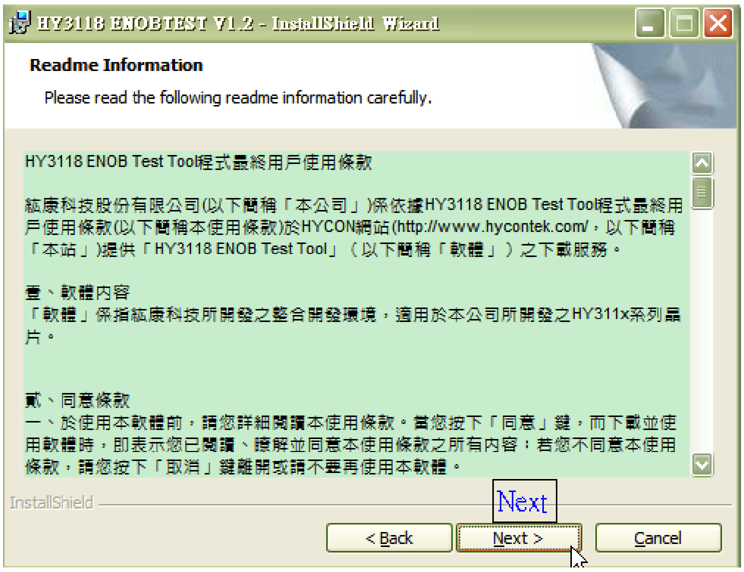
For certain operation system, it requires Administrator identity to install software to the computer.

- Look for Setup.exe and execute it from CD-ROM menu or unzip file. Proceeding the installation procedures as frame indicates. As shown in below dialog window.

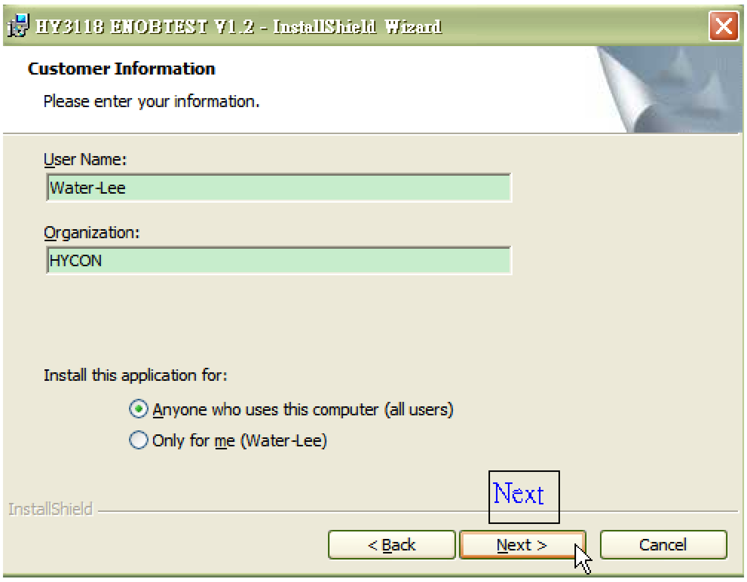




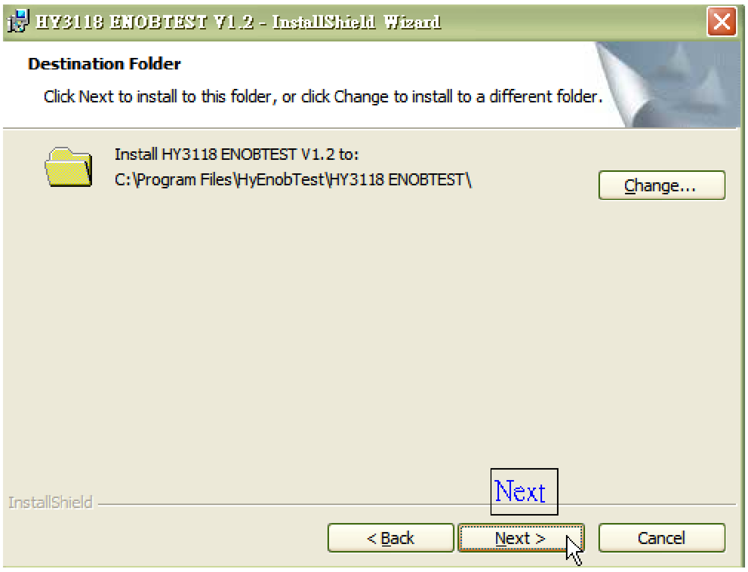
HY3118 ENOBTEST V1.2 - InstallShield Wizard
Welcome to the InstallShield Wizard for HY3118 ENOBTEST V1.2
The InstallShield(R) Wizard will install HY3118 ENOBTEST V1.2 on your computer. To continue, click Next.
WARNING: This program is protected by copyright law and international treaties.
Next
< Back
Next >
Cancel

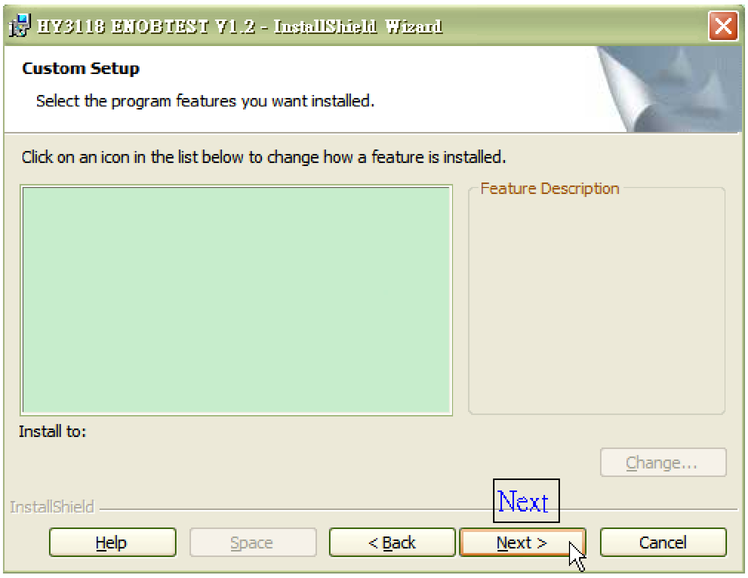


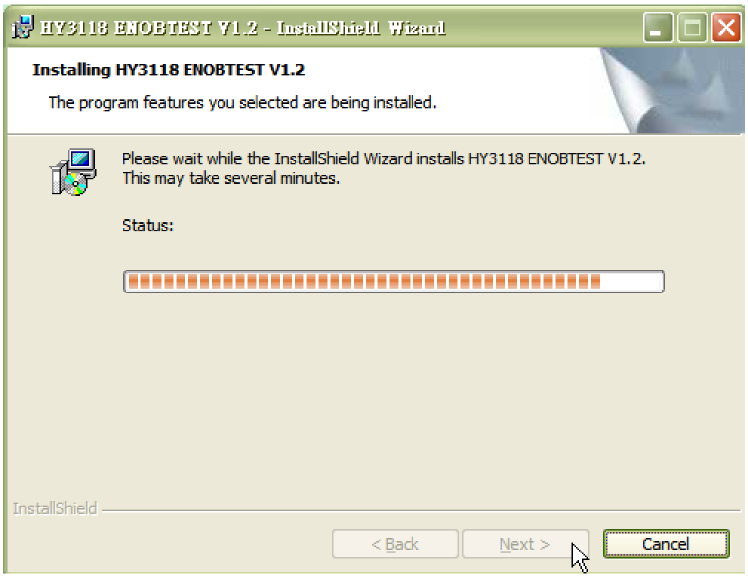
HY3118 ENOBTEST V1.2 - InstallShield Wizard
Readme Information
Please read the following readme information carefully.
HY3118 ENOB Test Tool程式最終用戶使用條款
紘康科技股份有限公司(以下簡稱「本公司」)係依據HY3118 ENOB Test Tool程式最終用戶使用條款(以下簡稱本使用條款)於HYCON網站(http://www.hycontek.com/，以下簡稱「本站」)提供「HY3118 ENOB Test Tool」（以下簡稱「軟體」）之下載服務。
壹、軟體內容
「軟體」係指紘康科技所開發之整合開發環境，適用於本公司所開發之HY311x系列晶片。
貳、同意條款
一、於使用本軟體前，請您詳細閱讀本使用條款。當您按下「同意」鍵，而下載並使用軟體時，即表示您已閱讀、瞭解並同意本使用條款之所有內容；若您不同意本使用條款，請您按下「取消」鍵離開或請不要再使用本軟體。
InstallShield
Next
< Back
Next >
Cancel

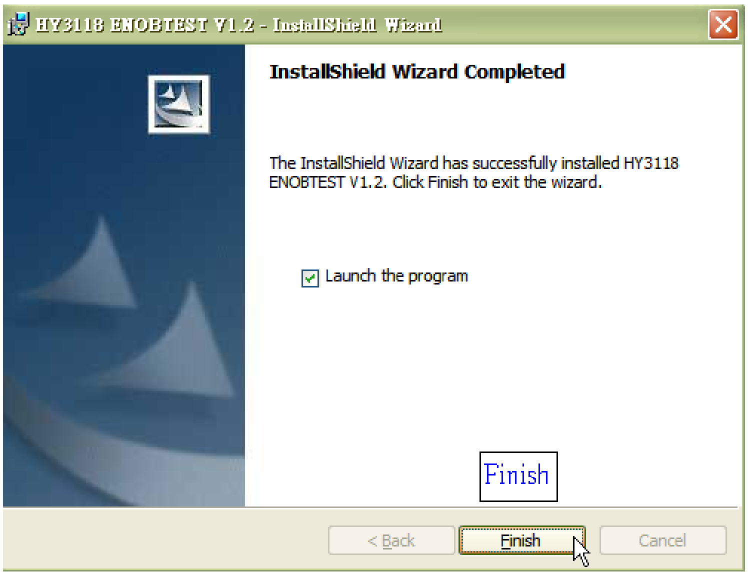


HY3118 ENOBTEST V1.2 - InstallShield Wizard
Customer Information
Please enter your information.
User Name:
Water-Lee
Organization:
HYCON
Install this application for:
Anyone who uses this computer (all users)
Only for me (Water-Lee)
InstallShield
Next
< Back
Next >
Cancel


HY3118 ENOBTEST V1.2 - InstallShield Wizard
Destination Folder
Click Next to install to this folder, or click Change to install to a different folder.
Install HY3118 ENOBTEST V1.2 to:
C:\Program Files\HyEnobTest\HY3118 ENOBTEST\
Change...
Next
InstallShield
< Back
Next >
Cancel


HY3118 ENOBTEST V1.2 - InstallShield Wizard
Custom Setup
Select the program features you want installed.
Click on an icon in the list below to change how a feature is installed.
Feature Description
Install to:
Change...
Next
InstallShield
Help
Space
< Back
Next >
Cancel


HY3118 ENOBTEST V1.2 - InstallShield Wizard
Installing HY3118 ENOBTEST V1.2
The program features you selected are being installed.
Please wait while the InstallShield Wizard installs HY3118 ENOBTEST V1.2.
This may take several minutes.
Status:
InstallShield
< Back
Next >
Cancel



2. Software Removal

To certain operation systems, it requires Administrator identity to remove software.

- Control panel（Start → setup → control panel）, clicking "install/remove program".



- After pressing "Yes", the program will be removed but no relative window will pop up.



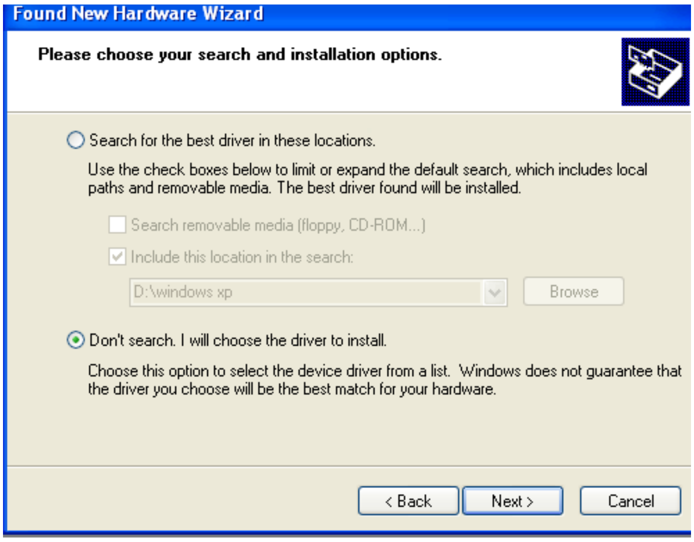
3. Hardware Installation

For certain operation systems, it requires Administrator identity to install hardware driving program.

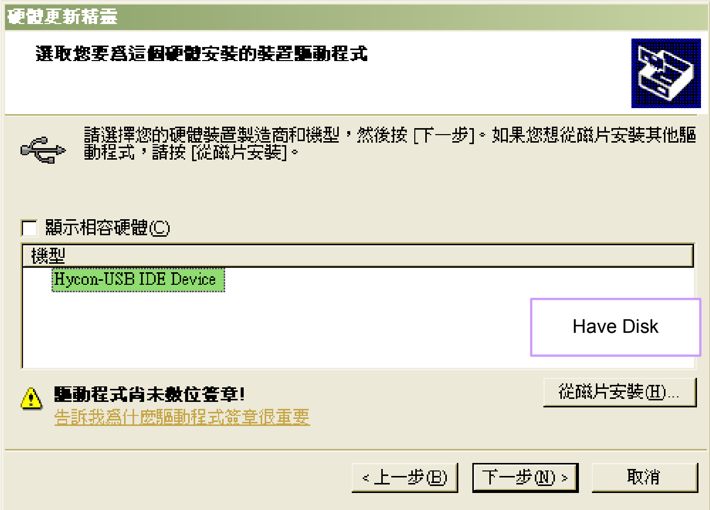
- When connecting PC and USB ENOB Test Board via USB wire, PC will find a new hardware. Please select "Install from a list or specific location (Advance)" and proceeds next step.



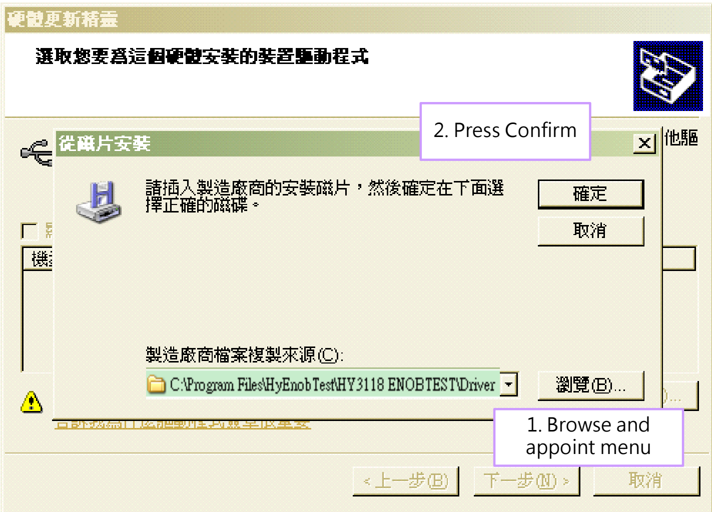
- Select "Don't search. I will choose the driver to install" and press next.



- Click "Have Disk".



- Click browse and assign driving program menu, the default location is "C:\Program Files\HyEnob Test\HY3118 ENOBTEST\Driver" and press yes.



- Select "Hycon-USB Temperature Reader Device" and press next. After compatibility warning shows up, please press "continue installation".



- Install complete



3. Software Menu Description

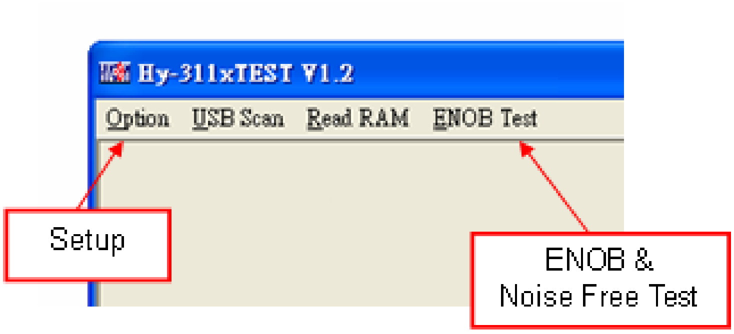


Figure 3-1

3.1 Option

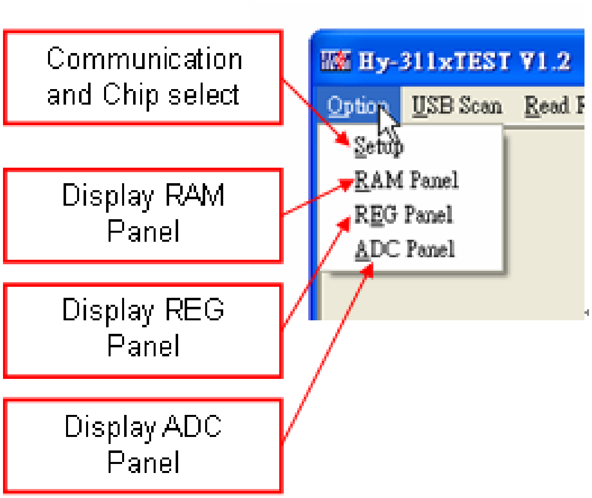


Figure 3-2

3.1.1 Setup

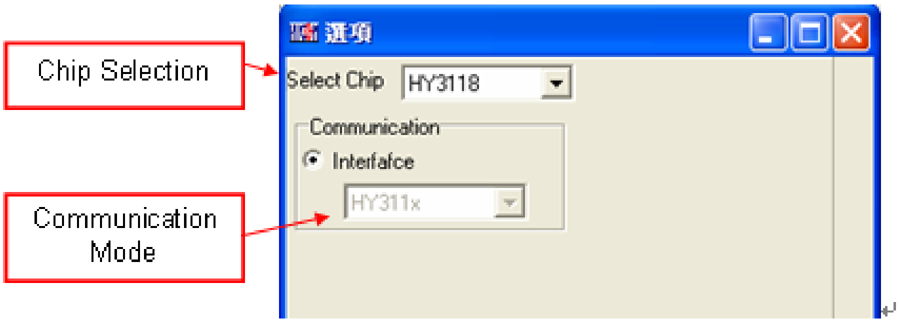


Figure 3-3

When test tool and HY311X series are connected, the device number and communication mode is set. User needs not to make other selection

3.1.2 RAM Panel

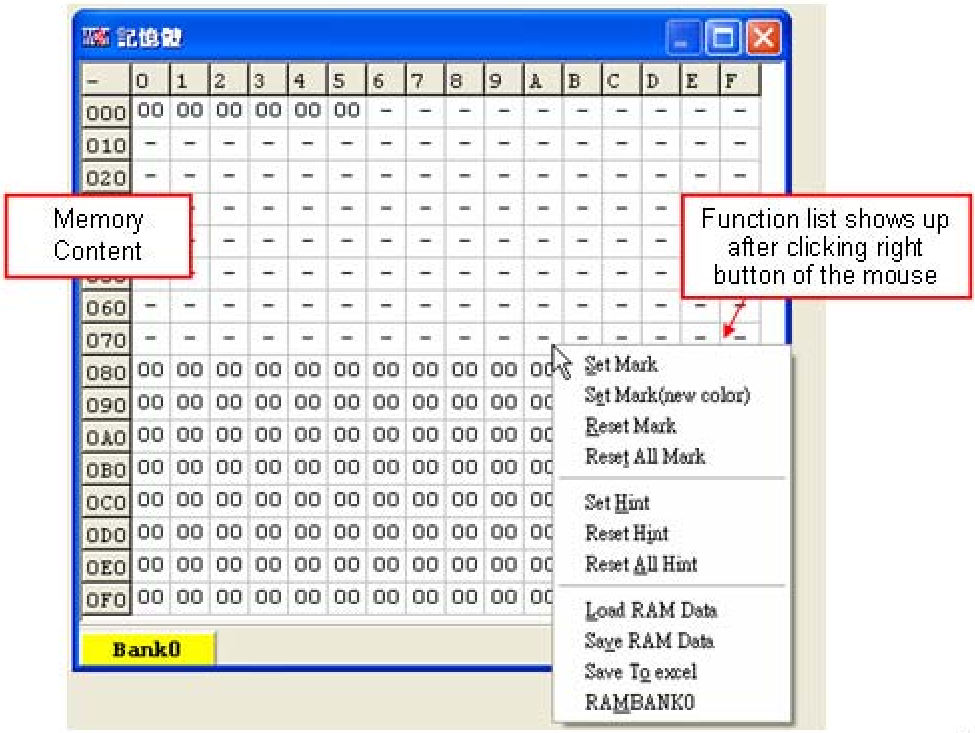


Figure 3-4

- Open RAM window, memory content of the chip will be displayed.
- If the address is inexistent, it will display －.
- If the address underlined number, it means Hint has been configured.
- The data in the address can be directly amended by clicking the left button on the address.
- By double-clicking the left button on the address, the window of amending data will show up.
- For detailed operation description, please refer to Chapter 3.2 of HY-IDE software user manual.

3.1.3 REG Panel

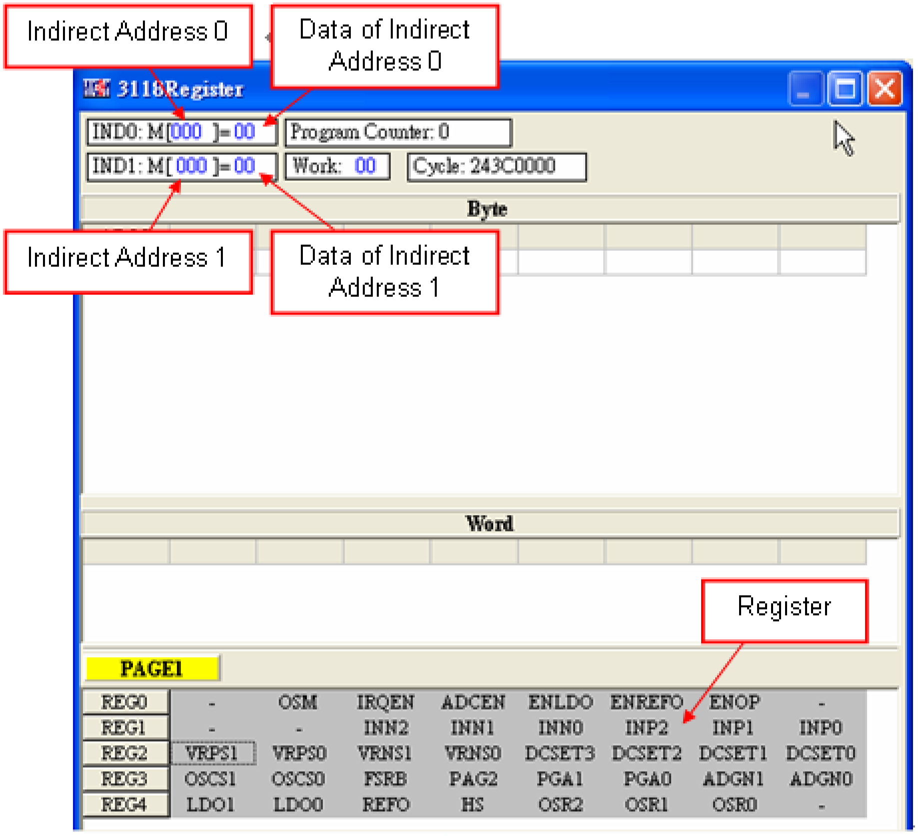


Figure 3-5

Please refer to Chapter 3.3 Register window operation of HY-IDE software user manual.

3.1.4 ADC Panel

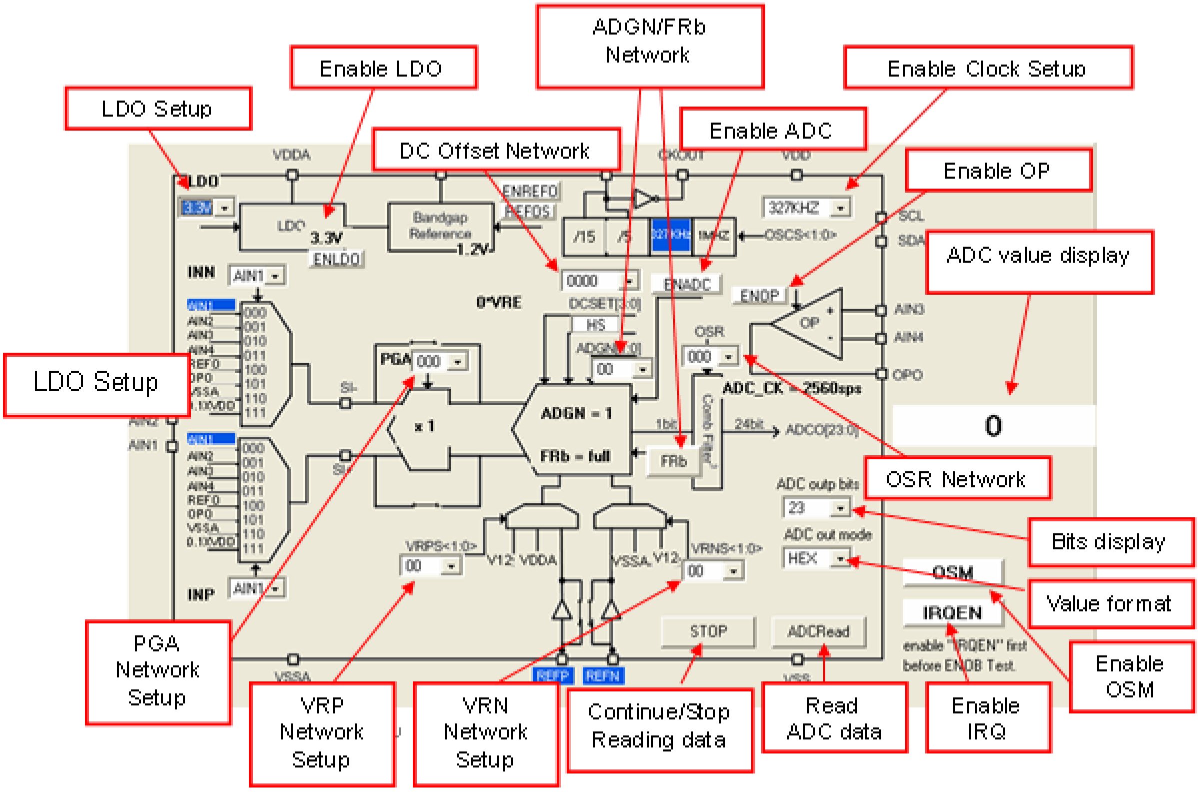


Figure 3-6

- Please refer to Chapter 3.6 of HY-IDE Software User Manual, ADC window operation.
- Setup parameters; please refer to HY311x Series datasheets.
- Please do not change setup value when ADC reads data, this may lead to unpredictable consequences.
- ADC value display:
  (1) Select ADC value output format, Hex or Dec format output.
  (2) Select Bit of ADC value, output from 8 to 23 Bit.
  (3) Press ADCRead, ADC output value will be display immediately; the format can be configured by users.
  (4) Press continually of reading data, the ADC output data will be displayed in Dec format.

3.2 USB Scan

When USB port is connected to ENOB control board, “USD On Line” will display as like the following

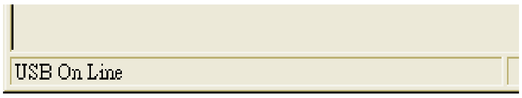


Figure 3-7

3.3 Read RAM

After “USB Scan” completed and “USB on Line” confirmed, please implement Read RAM. The RAM and Registers of chip will be read to the buffer zone of PC. It will affect RMS Noise and Peak-to-Peak Noise operation of ENOB Test.

4. ENOB Test

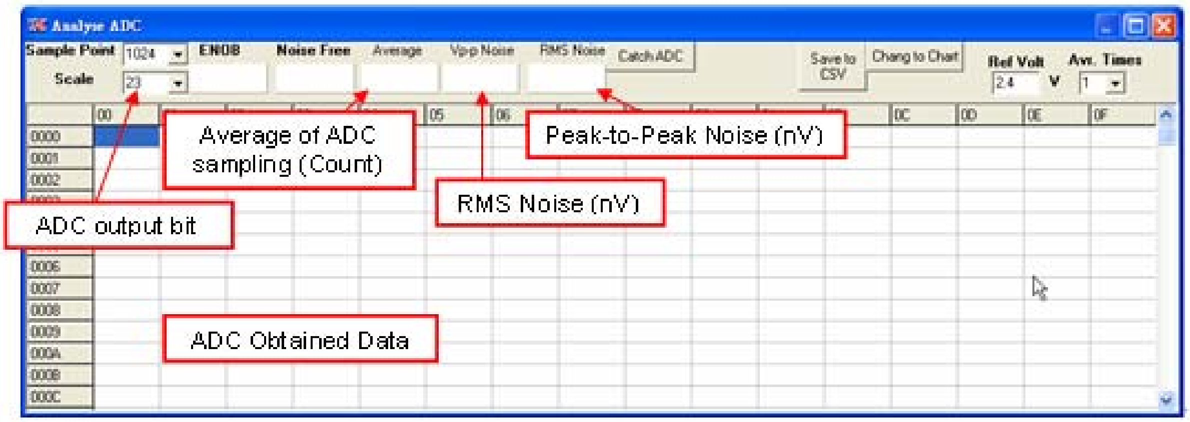


Figure 3-8

1. **Sample Point**

   ADC sample point of "Catch ADC" function. Minimum sample of OTP ADC output is 64 records and maximum is 65536 records.

2. **Scale**

   ADC output bit. Minimum ADC output bit is 8-bit and maximum is 23-bit.

3. **ENOB**

   Display ENOB, the calculation is shown as Equation 3, the unit is bit.

4. **Noise Free**

   Display Noise Free Bits, as Equation 4, the unit is Bit.

5. **Average**

   Display sampling average value of ADC, as Equation 1, the unit is Counts.

6. Vp-p Noise

Display Peak-to-Peak Noise, as Equation 5，the unit is nV.

7. RMS Noise

Display RMS Noise, as Equation 2, the unit is nV.

8. Catch ADC

Real-time catch and display ADC value in order. Please do not implement this function when ADC setup window displays data in continuous mode.

9. Save to CSV

Save the display value to *.CSV file, including ENOB, Noise Free, Average, Vp-p Noise and RMS Noise.

10. Change To Chart

Switch chart and value in value display zone.

11. Ref Volt

Input Reference Voltage (unit: V).

12. Avr. Times

Select software average, the value is display zone will perform average again, according to the times of selection and then display in value display zone.

5. Hardware Description

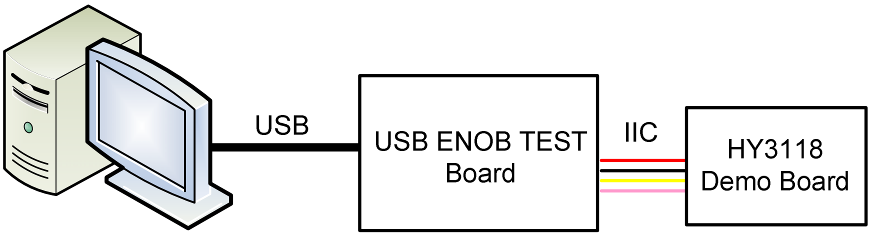


Figure 5-1

PC transmits Command to USB ENOB Test Board; USB ENOB Test Board configures and reads ADC value via IIC from Hycon HY311x Demo Board.

5.1 USB ENOB Test Board Description

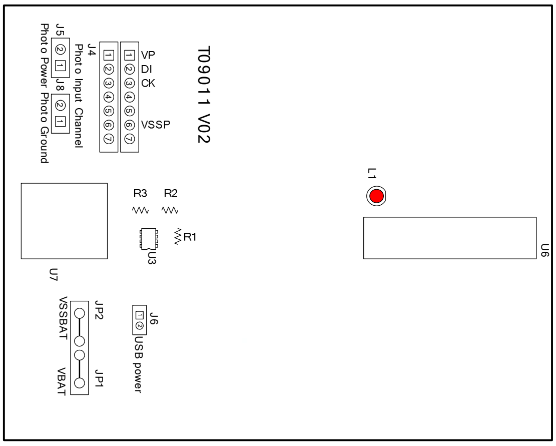


Figure 5-2

1. J4：IIC Port

J4 description

PIN 1 → VP, powered by J5 and J8.

PIN 2 → DI, IIC SDA signal wire.

PIN 3 → CK, IIC SCK signal wire.

PIN 4 → N/A

PIN 5 → N/A

PIN 6 → VSSP, Ground.

PIN 7 → N/A

2. JP1, JP2, J6 and U3：Power Supply Circuit

JP1 and JP2 are external power inputs that supply power to U3 and generate VDD power. Using USB power, J6 is short circuit. Using external 5V power, JP1 and JP2 inputs, J6 is open circuit. Regulated circuit that composed by U3, R1, R2 and R3 generates VDD power. Amending R1, R2 and R3 can change output voltage, the relation is as follows:

$$VDD = 1.240V \times \left(1 + \frac{R1 + R2}{R3}\right) \qquad (6)$$

3. U7：USB Port

Port connecting to PC, is the power source of entire system (5V), 500mA input.

5.2 HY311x Demo Board Description

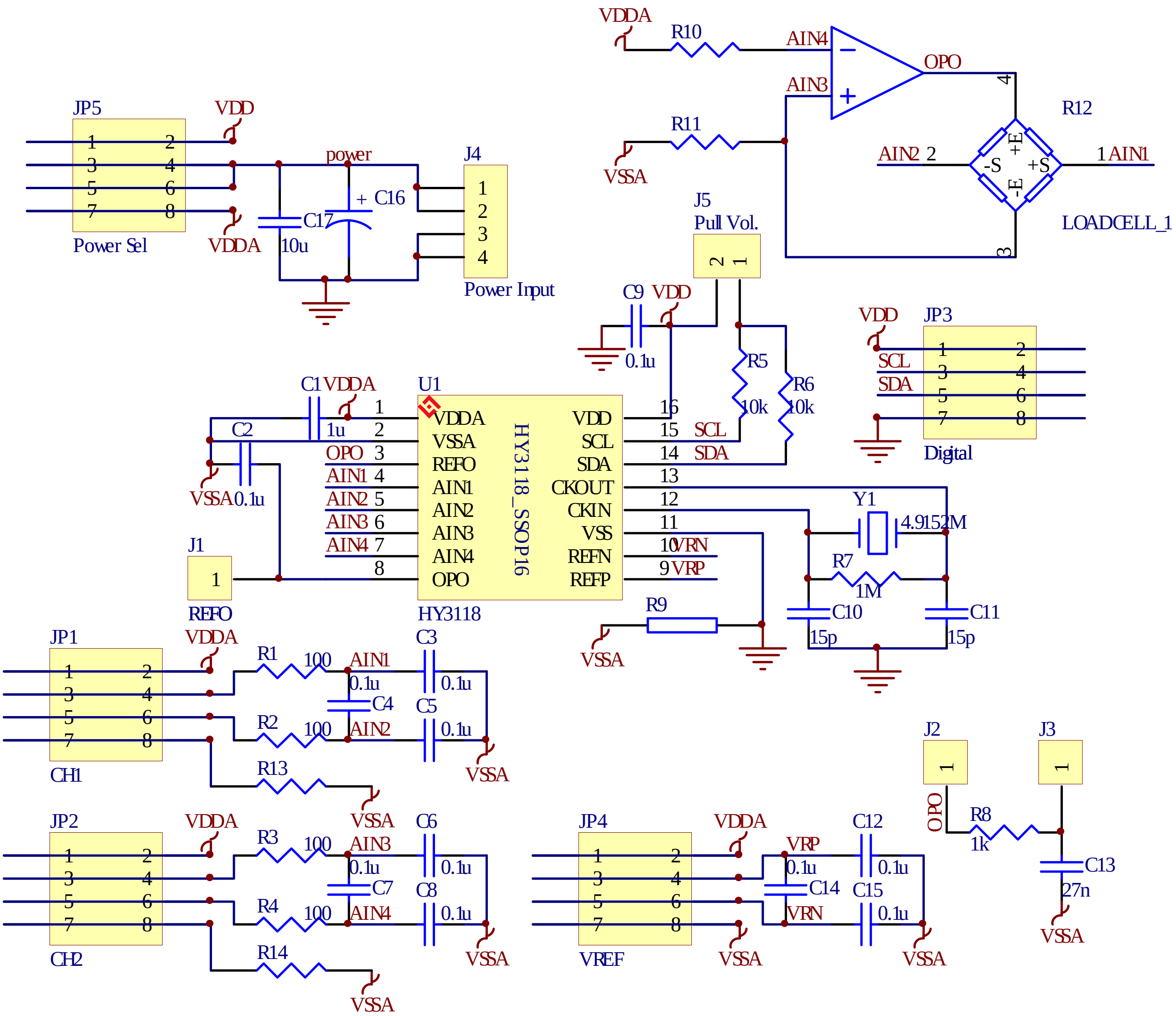


Figure 5-3

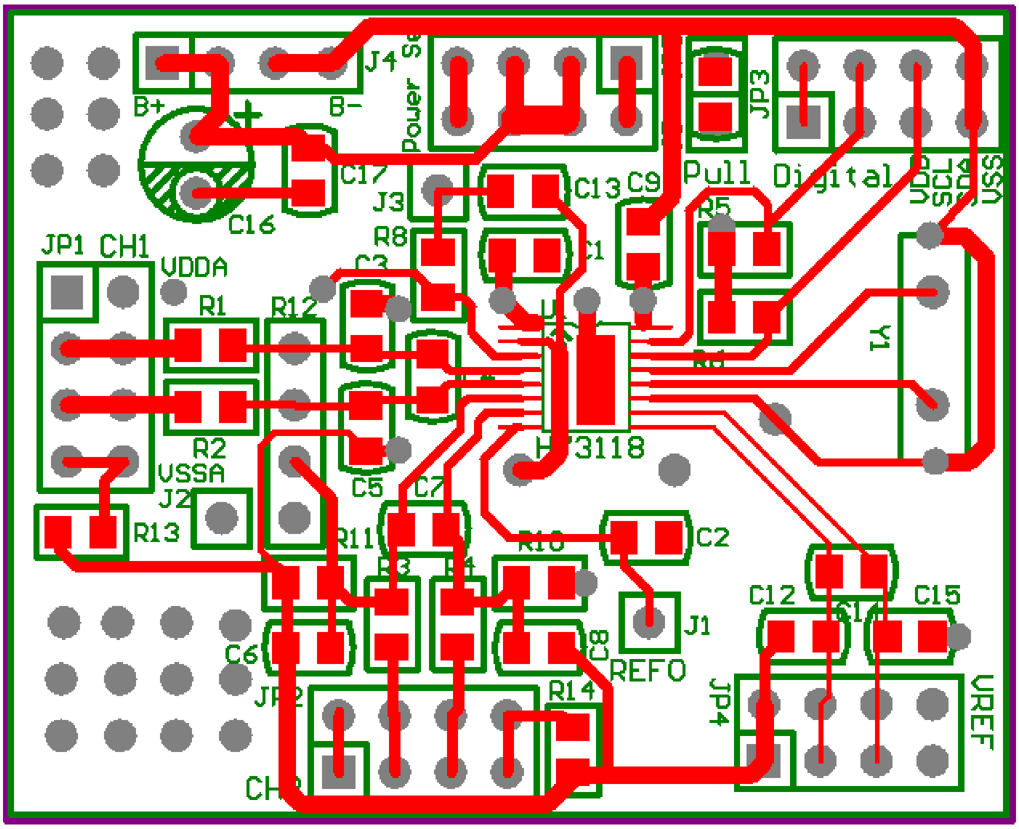


Figure 5-4

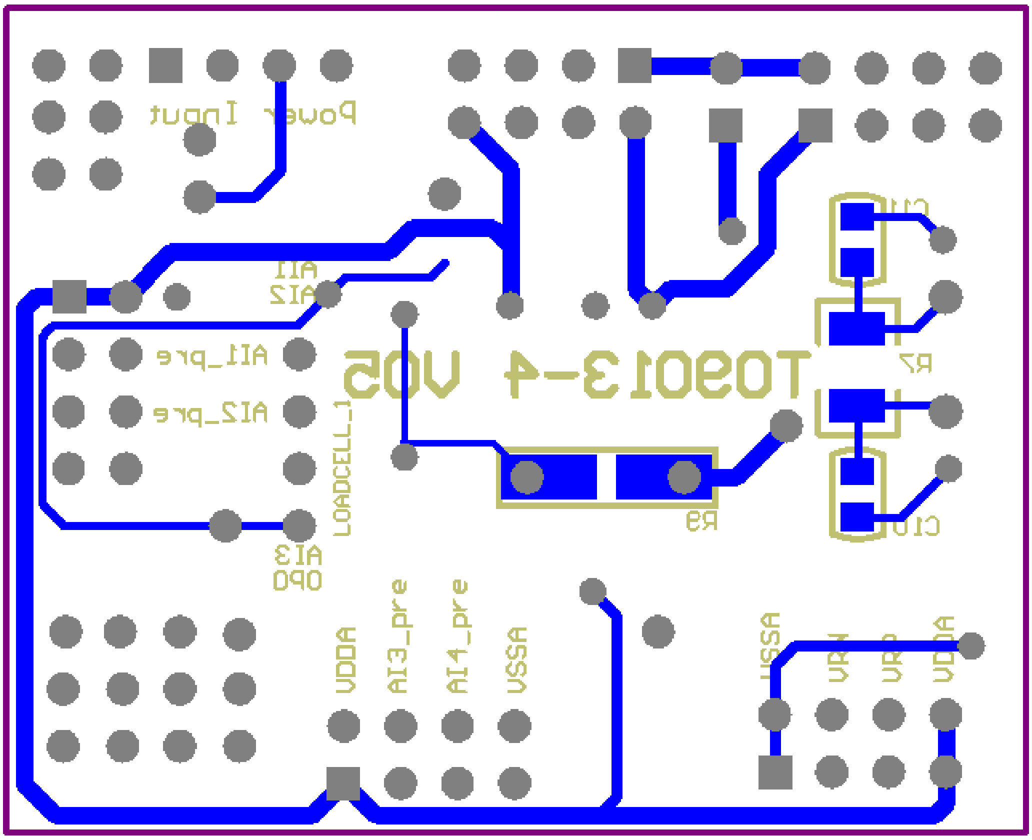


Figure 5-5

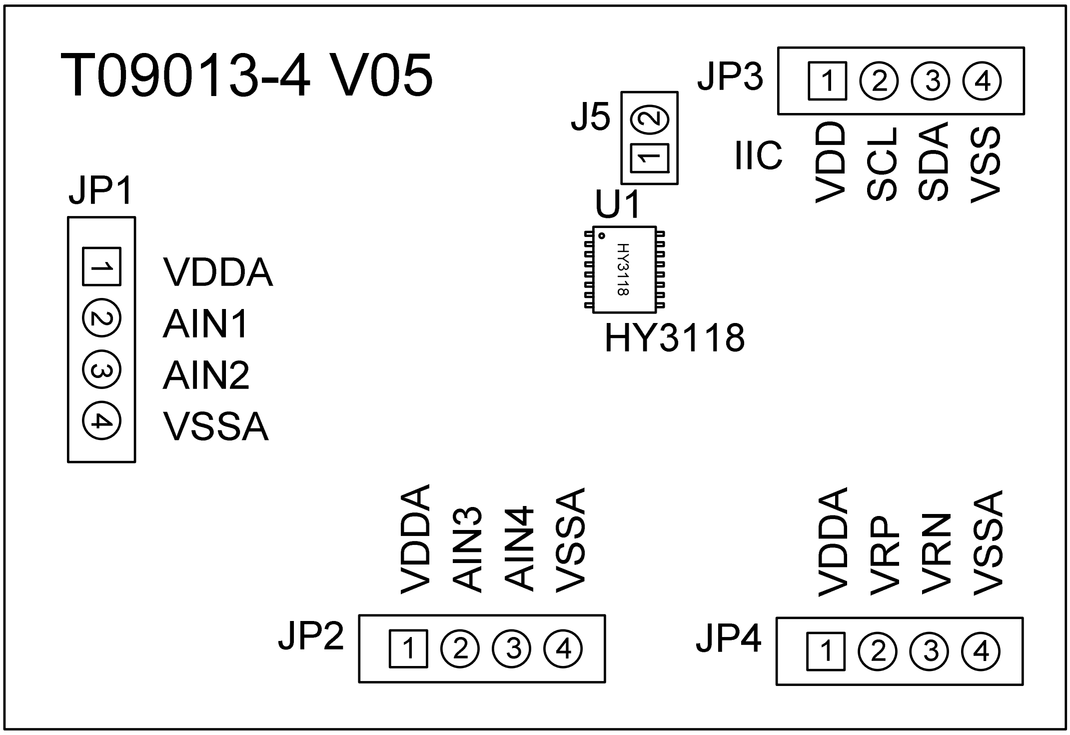


Figure 5-6

1. JP3：IIC Port

PIN 1 → VDD powered by 3.3V voltage via USB ENOB Test Board

PIN 2 → SCL, SCK signal wire

PIN 3 → SDA, SDA signal wire

PIN 4 → VSS, Ground.

2. JP1 and JP2：Signal Input End

PIN 1 → VDDA, VDDA power supply

PIN 2 → AIN1 / AI3, signal input end

PIN 3 → AIN2 / AI4, signal input end

PIN 4 → VSSA, Ground.

3. JP4：ADC Signal Reference End

PIN 1 → VDDA, VDDA power supply

PIN 2 → REFP (VRP), voltage input reference end

PIN 3 → REFN (VRN), voltage input reference end

PIN 4 → VSSA, Ground.

4. U1：Main Chip

HY3118 IC, SSOP 16 package type.

6. Question Obviation

1. Registers cannot be configured under ADC window?

USB Scan and Read RAM must be executed first. After that, ADC register value can be configured. If USB is connected and confirmed, configuration still cannot be implemented, please close program and remove USB. After plug in the USB, execute the program again.

2. Configuration of ADC window is relatively slow?

Please do not change any setup when ADC reads data, this might bring about unpredictable results.

3. Can the data obtained include time?

Data obtained from the program includes file that be saved as CSV format but not including time. Users can detect the X axis represents time in graphical display mode, demonstrating in ms. Time recording function will be incorporated in next version of program update.

4. Program cannot be executed, file lack appears and program demands to reinstall.

Please print the error window and message then please contact the distributor who provided this DMM EVA Test Tool to you or directly contact HYCON Technology for further support. We are sorry for the inconvenience that has caused to you.

5. INF error shows up when USB drive program is under installation or is completed and a yellow exclamation mark appears in "device manager".

Please copy all programs of Driver file in the installation menu to c:\windows\system32\drivers. Reinstall driving program again. If error shows up again, please contact the distributor who provided this DMM EVA Test Tool to you or directly contact HYCON Technology for further support.

7. Revision History

Major differences are stated thereinafter:

Version	Page	Revision Summary
V01	All	First Edition